



# LANCASTER LABORATORIES, INC.

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Agricultural Products Research, Development and Testing

October 23, 1970

Mr. Morris Holman, P.E.  
Chemical Leaman Trucking Lines  
506 Lancaster Avenue  
Downington, Pa. 19335

Re: Treatability Studies and Analysis of Raw  
Waste from Lagoon #2, William Dick Property,  
West Caln. Township.

Dear Mr. Holman:

About 15 gallons of the raw waste was received from you on October 7, 1970 and assigned our Lab. #WW-321. It was milky white in appearance, its pH 7.3. A previous batch of the same raw waste had been received, our Lab. #WW-289, and its analysis and toxicity report have already been submitted to you on October 9, 1970.

Treatability Experiments: - Our "jar test" conditions are described as follows:

1,000 ml of raw waste was stirred at about 100 rpm for 2 minutes, added flocculating agent, stirred 1 minute more, then reduced stirring speed to 20-25 rpm and stirred for 10 minutes, then added lime (in slurried form) and stirred further for 10 minutes. After this stirring was stopped and the floc allowed to settle for  $\frac{1}{2}$  hr. Supernatant was decanted after 30 minutes settling time and analysed. All the chemical analytical results are tabulated at the end of this report.

As treatability variables we studied alum, ferric chloride and ferric sulfate as flocculating agents over a rather narrow concentration range, since you had already established an approximate threshold level for alum. After addition of the flocculating agent, pH falls, and hence the addition of lime to bring the pH to neutral. Lime seems to improve the quality of floc and supernatant and would certainly minimize the presence in the supernatant of the metal ion used for flocculation.

(1) Alum Flocculation: - At the 1,000 ppm level of alum and 300 ppm lime, flocculation is immediate and the clarity of supernatant is good. Floc settles slower than in the case of ferric chloride and ferric sulfate. After 30 minutes settling, a few fine particles are seen suspended in the supernatant. The analytical data from the supernatant show the total solids to have been reduced by almost 50%; suspended solids practically 100%, and COD value by about 74%. BOD value is not reduced to any great extent. Supernatant pH is 7.65.

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In another experiment flocculation was carried out using 750 ppm of alum and 250 ppm of lime. The floc and the supernatant appeared to be very similar to the first experiment but COD value of the second supernatant was slightly higher. Attempted flocculation by adding lime first failed as did flocculation trials using 500 ppm alum. In both the cases, the floc is not good and supernatant very turbid.

(2) Ferric Chloride Flocculation: - Ferric chloride at 1,000 ppm and lime at the 300 ppm level yielded an excellent floc and very clear supernatant. The clarity of this supernatant looked the best among all the experiments. The floc settled faster than in No. 1. There were hardly any suspended particles in the supernatant after  $\frac{1}{2}$  hour settling. The analytical results from the supernatant show the total solids reduction to be about 50%, suspended solids - practically 100%, and COD value reduction by about 76%. There is not great reduction in BOD value - Supernatant pH 7.4.

Flocculation experiments using 750 ppm ferric chloride and 250 ppm lime did not give desirable results. The supernatant looks very turbid, and this is reflected in its higher COD value. Also the flocculation with 500 ppm ferric chloride gave equally bad results as did the addition of lime prior to flocculating agent.

(3) Ferric Sulfate Flocculation: - Satisfactory results were obtained by using 1,000 ppm of ferric sulfate and 300 ppm of lime. There was immediate flocculation and the clarity of supernatant was equal to (2) after  $\frac{1}{2}$  hr. settling. The rate of settling is faster than in (1) and (2).

The chemical composition of the supernatant is practically the same as in (2) using 1,000 ppm ferric chloride, except that total solids removal is slightly less. It was interesting to note that this supernatant become slightly turbid on standing, but this slight increase in turbidity did not have any adverse effect on the quality of supernatant. A flocculation experiment using 750 ppm Ferric Sulfate and 250 ppm lime was unsuccessful, as was addition of lime prior to flocculant and use of 500 ppm ferric sulfate. In both the cases flocs were not good and supernatants very turbid.

Recommendations and Conclusions: - Based on data presented above we recommend the use of Ferric Sulfate (1,000 ppm) and lime (300 ppm) as the most efficient and practical system for flocculating suspended materials from your lagoon wastes prior to disposal of the supernatant via irrigation onto soil. The following reasons are offered for this recommendation:

(1) The iron salts seem to provide a somewhat better removal of COD, and provide a heavier and somewhat more compact floc.

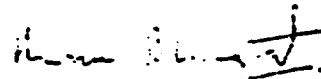
(2) Trace amounts of iron in the supernatant when applied to a soil would likely serve as a nutritional adjunct, as opposed to alum.

(3) The sulfate is chosen over the chloride strictly because of economic considerations.


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Based on our past chemical and bioassay data, it is my opinion that the means of disposal anticipated at the outset of our studies (i.e. flocculation, disposal of supernatant via land irrigation and covering over of the sludge within the lagoons with soil) is a safe and practically feasible system. As pointed out to you verbally the excellent COD removals encountered are significant in view of the relatively poor BOD reductions. Objectively interpreted it simply means that the more slowly biodegradable material has largely been removed by flocculation, so that supernatant pumped onto land should biodegrade in the surface soil quite readily.

Respectfully Submitted,



Minu Bhagat  
Analytical Chemist



Earl H. Hess, Ph.D.  
President

MB:EHH:eh

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Chemical Analysis Data on Raw and Treated Waste

<u>Sample Designation</u>	<u>pH</u>	<u>COD</u>	<u>BOD</u>	<u>Total Solids</u>		<u>Suspended Solids</u>	
				<u>Total</u>	<u>Volatile</u>	<u>Total</u>	<u>Volatile</u>
#MW-321 - Raw Waste from Lagoon	7.3	6615	921	4214	3602	298	298
(1) Supernatant of 1000 ppm alum + 300 ppm lime	7.7	1716	618	2174	1055	15	15
Supernatant of 750 ppm alum + 250 ppm lime	8.0	1789	-	-	-	-	-
(2) Supernatant of 1000 ppm Ferric Chloride + 300 ppm lime	7.4	1559	615	1937	906	7	7
Supernatant of 750 ppm ferric chloride + 250 ppm lime	7.5	1992	-	-	-	-	-
(3) Supernatant of 1000 ppm ferric sulfate + 300 ppm lime	7.3	1559	656	2197	967	7	7
Supernatant of 750 ppm ferric Sulfate + 250 ppm lime	7.3	2288	-	-	-	-	-

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